

# HAWAII PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 43*

Ninth Progress Report  
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Hydrometeorological Design Studies Center  
Hydrology Laboratory

Office of Hydrologic Development  
U.S. National Weather Service  
National Oceanic and Atmospheric Administration  
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## DISCLAIMER

The data and information presented in this report should be considered as preliminary and are provided only to demonstrate current progress on the various technical tasks associated with this project. Values presented herein are NOT intended for any other use beyond the scope of this progress report. Anyone using any data or information presented in this report for any purpose other than for what it was intended does so at their own risk.

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## 1. Introduction

The Hydrometeorological Design Studies Center (HDSC), Hydrology Laboratory, Office of Hydrologic Development, U.S. National Weather Service is updating its precipitation frequency estimates for Hawaii. Current precipitation frequency estimates for Hawaii are contained in *Technical Paper No. 43*, "Rainfall-Frequency Atlas of the Hawaiian Islands for Areas to 200 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years" (U.S. Weather Bureau 1962). The update includes collecting data and performing quality control, compiling and formatting datasets for analyses, selecting applicable frequency distributions and fitting techniques, analyzing data, mapping and preparing reports and other documentation.

The Project will determine annual precipitation frequencies for durations from 5 minutes to 60 days, for return periods from 2 to 1000 years. The Project will review and process all available rainfall data for the Project area and use accepted statistical methods. The Project results will be published as a Volume of NOAA Atlas 14 on the internet using web pages with the ability to download digital files.

The Project area covers the Hawaiian islands including Hawaii, Maui, Lanai, Molokai, Oahu, and Kauai. The Project area including preliminary regions is shown in Figure 1.

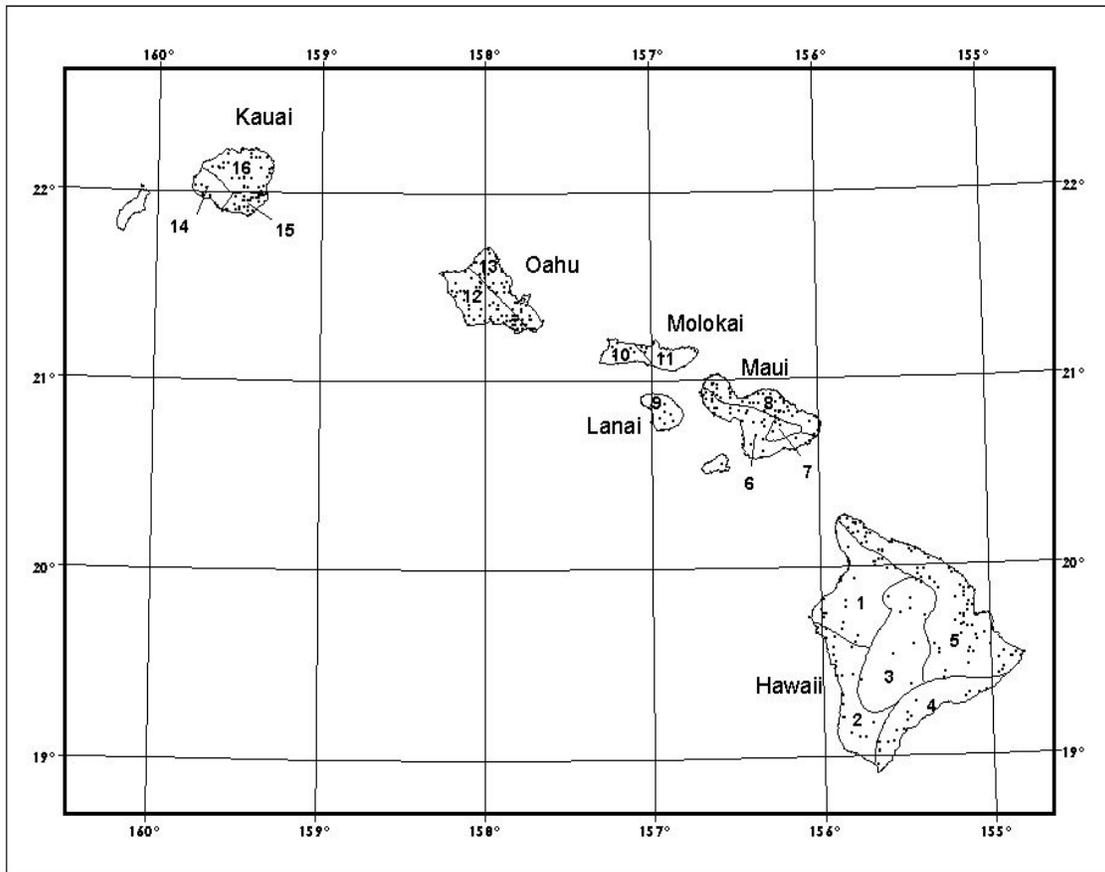


Figure 1. Hawaii Precipitation Frequency Project area, regional divisions and daily station locations.

## 2. Highlights

Reductions in funding will cause delays in the Hawaii and Puerto Rico projects. Additional information is provided in Section 4.2, Hawaii and Puerto Rico Schedules/Funding.

Data entry of monthly maximums from daily gages maintained by the State was completed by the University of Hawaii during the quarter. HDSC received the final CD containing data from Kauai. Quality control of the data from the State maintained gages was begun. Additional information on this subject is available in Section 3.1, Data Collection and Quality Control.

Software was written to accommodate different numbers of stations at different multi-day durations to retain as much data as possible. Software to expedite the regionalization process was written. Work has begun on software to examine stations that are near each other and may be correlated. Additional information is provided in Section 3.2, Software Updates.

A web-page template to provide access to huge volumes of data, including spatial (GIS) data, was developed. In the next few weeks, the PFDS will be opened to the public as the final precipitation frequency estimates for the Semiarid Southwestern United States are made available. Additional information is provided in Section 3.3, Precipitation Frequency Data Server.

Progress continues in the development of the geographically-fixed depth-area-reduction (DAR) relationships for area sizes of 10 to 400 square miles in the United States. The name of this project has been officially changed to the DAR project (formerly was depth-area-duration, DAD). Testing and evaluation of pre-processing statistical results is nearly complete. Testing of the semi-objective grouping procedure used in NOAA Technical Report NWS 24 (TR-24) was conducted. Work began on the actual determination of depth area ratios. Additional information is provided in Section 3.4, Spatial Relations (Depth Area Duration Project).

### 3. Progress in this Reporting Period

#### 3.1 Data Collection and Quality Control.

Data entry of monthly maximums from daily gages maintained by the State was completed by the University of Hawaii during the quarter. HDSC received the final CD containing data from Kauai which completed the hand entered data set for the Islands.

Quality control of the data from the State maintained gages was begun. Errors and inconsistencies in the hand entered data were reported back to the University of Hawaii. These problems were subsequently resolved and delivered back to HDSC. The problems discovered during the quality control consisted of: duplicate station names containing different data, incorrect station meta data and data not being sequential from earliest to latest date at a particular station.

#### 3.2 Software Updates

Software was written to accommodate different number of stations at different longer durations during the L-moment calculations for a region. Different numbers of stations at a longer duration may occur when a station does not have the minimum amount of data necessary in a given year to extract an annual maximum. If the station no longer has at least 30 years of annual maximums, it is not included in the analysis and causes a discrepancy.

Software was written to expedite the subdivision process when creating homogeneous regions. The software enables the shifting of stations from one region to another with a simple command, thus reducing the amount of time spent on regionalization more than in half. This will ensure a more rapid completion of the Hawaii Project.

Work has begun on examining stations that are near to each other that may be correlated. Software to compare station annual maxima series and tally concurrent years and annual maxima that coincide has been written.

#### 3.3 Precipitation Frequency Data Server (PFDS)

Other than minor bug fixes, the Precipitation Frequency Data Server underwent few changes. Most notably, however, was the development of a GIS/Data download web-page template. The template is designed to provide access to huge volumes of data, including spatial (GIS) data, in a clear and organized manner. The template, which will be used for each individual state, will be first used for the upcoming delivery of the final Semiarid Southwestern United States data.

In the next few weeks, the PFDS will be opened to the public as the final precipitation frequency estimates for the Semiarid Southwestern United States are made available. This will provide the first opportunity for the public to view the type of final deliverables that HDSC will provide. The documentation to accompany the precipitation frequency estimates will be completed and posted on-line in September.

### 3.4 Spatial Relations (Depth-Area-Reduction Project)

Progress continues in the development of the geographically-fixed depth-area-reduction (DAR) relationships for area sizes of 10 to 400 square miles in the United States. Since depth-area-duration (DAD) relates more to probable maximum precipitation applications and storm-centered analyses, the name of this project has been officially changed to the DAR project. Testing and evaluation of pre-processing statistical results using the Chicago, IL and Walnut Gulch, AZ networks are nearly complete. Several tests of a 5-station grouping process were conducted to determine the sensitivity of the semi-objective grouping procedure used in NOAA Technical Report NWS 24 (TR-24), which is also being used in this study. After careful inspection of the text and graphics in TR-24, we were able to reproduce the pre-processed results using the Chicago, IL data, despite the fact that the TR-24 description of 5-station relative means was somewhat ambiguous. Near the end of this quarter, work began on duplicating the procedures discussed in TR-24 chapter 6, the actual determination of depth area ratios.

A total of 13 different geographic areas throughout the United States have been quality controlled and will be used in the project. The set of curves developed for each area will be tested for differences to determine if a single set of D-A-D curves is applicable to the entire U.S. Otherwise, separate curves for different regions of the country will be developed.

## **4. Issues**

### 4.1 USACE Meeting

Geoff Bonnin, representing HDSC, presented a paper at the "World Water and Environmental Resources Congress 2003" sponsored by the Environmental and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) in June. The paper, *Recent Updates to NOAA/NWS Rainfall Frequency Atlases*, was well-received and generated significant interest and anticipation of final publication.

### 4.2 Hawaii and Puerto Rico Schedules/Funding

The U.S. Army Corps of Engineers has significantly cut its funding for precipitation frequency studies for FY 2003. The reduction in funding will move completion of both the Puerto Rico and Hawaii projects into FY 2004.

## 5. Projected Schedule and Remaining Tasks

The following list provides a tentative schedule with completion dates. Brief descriptions of tasks being worked on next quarter are also included in this section.

- Data Collection and Quality Control [December 2003]
- Trend Analysis [January 2004]
- L-Moment Analysis/Frequency Distribution [March 2004]
- Temporal Distributions of Extreme Rainfall [March 2004]
- Spatial Interpolation [May 2004]
- Peer Review of Spatially Distributed Estimates [June 2004]
- Precipitation Frequency Maps [September 2004]
- Web Publication [September 2004]
- Spatial Relations (Depth Area Duration Studies) [September 2003]

We expect to be able to obtain NCDC data through 2002 and then start the quality control and testing of the regionalization on an island by island basis as complete data sets are assembled. The estimation of the appropriate probability distribution functions and the parameterization of these functions as well as the spatial interpolation steps will be done for all islands as a group to ensure consistency in this part of the process.

### 5.1 Data Collection and Quality Control.

HDSC will begin collection of the latest NCDC rainfall data and perform formatting and QC as time permits.

### 5.2 Spatial Relations (Depth-Area-Duration Project)

Software for the D-A-R computations will be completed in the next quarter and the computations will be performed for 13 areas, and the resulting curves will be tested for differences to determine if a single set of D-A-R curves is applicable to the entire U.S. or whether curves vary by region.

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